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CRITIQUES AND CONTENTIONS

Public understanding of science at the crossroads

Steve Miller

With the publication of the House of Lords report “Science and Society” in the spring of 2000, public understanding of science in the United Kingdom is now at something of a crossroads. After well over a decade of efforts to improve what has come to be known as “scientific literacy” among the general population—led by such organizations as the Committee on Public Understanding of Science (CoPUS)—surveys suggest that little has been achieved. But how are we now to interpret this? Is it a failure by the scientific community to “get their message across?” Is the public just insufficiently interested in matters scientific? Or is it that the relationship between the public and scientists, and the dispersal and uptake of information, is more subtle than simple measurement models suppose? And how can the “new age,” as envisioned by their Lordships, be realized?

It is always dangerous to date the start of a historical process. But for the recent movement for public understanding of science within the United Kingdom, the publication by the Royal Society, in 1985, of a report entitled “The Public Understanding of Science”—known as the Bodmer Report after the chair of the working group, Sir Walter Bodmer—is a reasonable place to begin a short survey of recent public understanding of science activity.[1] To support the claim that we are now at a crossroads, the House of Lords report “Science and Society,” published in March 2000, is a good pointer to how attitudes have changed in the intervening 15 years.[2] In between these two reports, there has been a government White Paper entitled “Realising our Potential” (1993).[3] There has also been an Office of Science and Technology report, chaired by the former Astronomer Royal, Sir Arnold Wolfendale.[4]

The story of public science in the United Kingdom since the Second World War is complicated. Public attitudes to science, at least insofar as they are reflected in the media, showed periods of great adulation and expectation immediately after the war, followed by disappointment and even hostility, giving way to a generally ambiguous viewpoint.[5] Alongside these “mood swings” there was a tendency for scientists to retreat into their shells, frowning on those who ventured onto the public stage, thus mirroring attitudes of their counterparts in the United States.[6] In part, the Bodmer Report reflected a concern amongst the scientific establishment that this retreat had reached such proportions that it made funding for scientific research politically vulnerable.

Bodmer set out to reverse this trend. Britain’s scientists were told that they had no less than a duty to communicate with the public about their work. From being an activity carried out by superannuated boffins or second-rate minds, popularizing science was *legitimized* by Bodmer.

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One of the main outcomes of the Bodmer Report was the setting up of CoPUS, a tripartite organization with representatives from the Royal Society itself, the British Association for the Advancement of Science, and the Royal Institution. CoPUS set in place a number of schemes to promote public understanding and appreciation of matters scientific. These included a grants line for public understanding of science practitioners, an annual popular science book prize, and a scheme to provide speakers making science relevant to members of the Women's Institutes.

One clear motivation for setting up these and other science promotion schemes was that it was hoped that science itself would be a beneficiary of increased scientific literacy: the more the public know science, the more they'll come to love it, was the argument on the positive side; ignorance breeds fear and loathing was the less sanguine way of arguing the case. But there were a number of other economic, social, political, and cultural benefits which, it was felt, would also accrue from such an increase.[7]

Following the lead of CoPUS–particularly in the wake of "Realising Our Potential"–Britain's research councils also began to institute their own public understanding of science schemes and to make funds available to their own communities for participation in such activities. In contrast to the pre-CoPUS view that only very senior and (probably) research inactive scientists had earned the right to talk to the general populace, many of these schemes targeted young scientists. In particular, Royal Society university fellows and postdoctoral researchers at the start of their academic careers were encouraged to go on media training courses and even to take a month or two out to work as journalists and broadcasters. So a second effect of Bodmer was that the U.K.'s scientific community was *mobilized* for public understanding of science.

So what was the outcome of the CoPUS years? Was the British public *scientized* in the way that the leaders of the scientific community had hoped? Sadly (?) they were not.

Since the 1950s, the American public has been occasionally surveyed about its understanding of and attitudes toward science.[8] Since the 1970s, such surveys have occurred regularly.[9] Taken together, these surveys show little improvement in adult scientific literacy no matter what the U.S. government or the American Association for the Advancement of Science tries—a source of deep pessimism for some.[10] In 1988, shortly after CoPUS was established, the first survey of the British public took place, showing scientific literacy levels very similar to those in the United States—i.e., 10 percent or less of those questioned were scientifically literate, depending on the exact definition used.[11]

For its tenth anniversary, CoPUS commissioned a team of consultants to look at the various public understanding of science schemes it was running.[12] The consultants reported that the schemes were all running well. They suggested that some of them were running so well that CoPUS should hand them on to other agencies, while it concentrated on further innovation. So how could it be that the 1996 follow-up to the 1988 survey indicated little change in scientific literacy, other than increased recognition of the initials DNA?[13] (On the positive side, public *interest* in science, in contrast to knowledge, remained very high, as did confidence in scientists themselves—so long as they did not work for the food industry or the Ministry of Agriculture: BSE had taken its toll there.)

Increasingly, the finger of guilt pointed toward what had become known as the "deficit model," which assumed "public deficiency, but scientific sufficiency."[14] This model adopted a one-way, top-down communication process, in which scientists—with all the required information—filled the knowledge vacuum in the scientifically illiterate general public as they saw fit. There was a flow of knowledge, from the "pure" source of science in the laboratory to a (somewhat tainted) Bowdlerised variety that was fit for public consumption and was usually disseminated through the mass media. The scientific community was most definitely in control of this flow.[15] Scientific facts and methods were the vital components of public understanding for the deficit model.

The leading scientists involved with CoPUS and the deficit approach it tended to adopt were, of course, highly intelligent people used to basing their views on evidence. And surveys did show that there was clearly some sort of deficit—in 1988, more than 80 percent of those interviewed declared themselves interested or very interested in science, but only 20 percent thought they were well informed in this area. What comparison of the two sets of survey figures revealed was that this deficit was not getting any smaller, the efforts of CoPUS during the intervening years notwithstanding. The deficit model did not deliver. (What the comparison between the 1988 and 1996 surveys could not answer was "would the situation have been worse had CoPUS *not* existed?" Or, put another way, would the great British public be unable to tell the difference between "The X-Files" and reality, as one leading scientist feared.)[16]

While CoPUS was undertaking its activities, alongside—but very separate from—its efforts a more reflective approach to public understanding of science was developing. This approach drew from sociology and history, and sometimes from philosophy, too. Scientific facts and their public assimilation were not as unproblematic as the deficit modelers assumed. Studies by such workers as Brian Wynne and Alan Irwin showed the importance of social context and lay knowledge as playing a significant part in how science was used by members of the public: interpretation was not an unambiguous process.[17]

Others, such as H. M. Collins and Trevor Pinch and Bruno Latour showed that the scientific process departed markedly from the hypothesis-experiment-falsification/verification method usually put forward in public as the way science progresses.[18] Instead, various *social* checks and balances came into play before what could be termed "reliable knowledge" could be obtained.[19] It was vital for the public to realize that a lot of the science they came across in acute, and potentially threatening, situations was of a "science-in-the-making" variety that was still being "socialized" by the scientific community; "textbook" scientific certainties rarely hit the headlines to grab the public's attention.[20]

These considerations gave rise to what is termed the "contextual approach" to public understanding of science.[21] This approach sees the generation of new public knowledge about science much more as a dialogue in which, while scientists may have scientific facts at their disposal, the members of the public concerned have local knowledge and an understanding of, and personal interest in, the problems to be solved. Practical experiments in this approach include consensus conferences, in which a well-briefed but lay group of citizens evaluate new scientific issues and techniques.[22] Science shops that issue information to concerned members of the general public for their specific and—usually—local use was another type of practical experiment conducted.[23]

It is this approach that is now to a large extent embodied in the House of Lords report "Science and Society." In contrast to Bodmer, bemoaning the level of public ignorance and the fickle nature of the media is almost totally absent. Instead, the report is peppered with calls for dialogue, discussion, and debate. A new era, which perhaps really opened when Science Minister Lord Sainsbury pronounced the "demise of the deficit model" at the 1999 meeting of the BAAS, is being ushered in. So what will this 3-D–dialogue, discussion, and debate—world of newPUS look like?

For a start, CoPUS is advised by their Lordships to reconstitute itself. It may even have to change its name, maybe to the Committee for Science and Society (or something similar), showing that it really has taken on board the spirit of the new age. The dust is still settling. Already waiting in the wings are groups of consultants poised with their own personal picture of how to fill the void—experts in evaluation processes, in organizing round-table discussions, in consultancy itself—professional "rent-a-dialogue's."

But we do not want to exchange a "science-fact-and-process" deficit for a consultancy deficit. It is important to ensure that efforts to involve the public in dialogue about important scientific matters that affect their lives and futures are firmly based on an understanding of the reasons why the original deficit model proved inadequate. There will have to be many experiments conducted to work out what *really* works by way of public involvement in science; what may work in one country, may not work in the United Kingdom.

A word of warning: the end of the deficit model does not mean there is no knowledge deficit. Government and industry pay out large sums of money to scientific researchers. If there is not a gap between what scientists and members of the general public know about science, then something is very wrong. We do not want a public understanding of science political correctness in which the very idea that scientists are more knowledgeable than ordinary citizens is taboo. Scientists and lay people are not on the same footing where scientific information is concerned, and knowledge, hard won by hours of research, and tried and tested over the years and decades, deserves respect.

Many communications about science will still mainly be about passing on the latest scientific knowledge: Royal Institution Christmas Lectures about string theory, BBC natural history programs on the behavior of chimpanzees will be as popular as ever. Schemes for training scientists to communicate about their work clearly and effectively will still be needed, as will funding to enable them to take part in public understanding of science activities.

What the past decade or so has brought to the fore, however, is that where science is being communicated, communicators need to be much more aware of the nature and existing knowledge of the intended audience. They need to know why the facts being communicated are required by the listeners, what their implications may be for the people on the receiving end, what the receivers might feel about the way those facts were gleaned, and where future research might lead. Communicators might also consider that factual communications—while they may be inspirational—probably have little lasting effect on knowledge levels. People will pick up the knowledge they need for the task at hand, use it as required, and then put it down again. It will not be ready to hand when the survey interviewer next asks them if, for example, an electron is bigger than an atom.

This means that the kind of scientific literacy surveys measure will always be of an elusive and mythical nature. But in real-life, stressful situations—as on an adventure holiday, where knowing that boiling water will kill viruses but antibiotics won't, and that this knowledge can be the difference between life and death—humans are very resourceful. Among their resources will be scientific knowledge gained at school and in later life—knowledge often deeply buried through lack of use or day-to-day relevance—or at least the knowledge of how to access such scientific knowledge as they may need.

As against the fact- and methodology-based definitions, scientific literacy of the kind John Durant defined as "knowing how science *really* works," comes into its own in the new situation in which public understanding of science is now developing: the social aspects of the generation of new knowledge and its validation.[24] Here is where the history of science can play an important role.

If CoPUS has legitimized science communication as a worthwhile and dutiful activity for scientists, the science to be communicated is still rather of the tried and tested variety—"safe science." Controversy and uncertainty, on the other hand, are still regarded as things that should be kept within the scientific community. If there is a leak—as there often is—to the media, and hence to the public, there is often much wringing of hands. "Not in front of the children" is still the attitude. But this, too, has to change.

In reviewing the public understanding of science scene a few years ago, Jane Gregory and I drew up a "protocol" for science communication aimed at facilitating genuine public understanding of science.[25] This included "acknowledging the place of popularization," particularly, and as is often the case with new, uncertain and controversial science, where it crossed disciplinary boundaries or where there are genuine public interest issues.

Historians of science have pointed out and instantiated the fact that, prior to the days of peer-reviewed journals and sectionalized science societies, the latest facts and theories about science were regularly discussed in public, and people were very used to seeing leading scientists slugging it out. In the early Royal Society, the lay public (albeit of a very restricted, gentlemanly, variety) was an essential part of the audience to validate the latest discoveries and techniques. Louis Pasteur put his theories on vaccination to a public test, in the full glare of hostile media attention.[26]

Of course, this public airing of science gave rise to all sorts of fads and fashions. Mesmerism and phrenology were all the rage in Victorian society. They went out of fashion, in the end, quite simply because they did not work. The cold fusion saga of the late 1980s is often held up to emphasize the dangers of new science going public. Maybe. But it is at least arguable that cold fusion died a fairly rapid death precisely because its grandiose claims were made so publicly, rather than being hidden away in an obscure electrochemistry journal. There the details would not have come under the scrutiny of the scientists across the chemistry/physics boundary who proved Pons and Fleischmann's process did not work.[27]

If we are entering a new age for public understanding of science, it is important that citizens get used to scientists arguing out controversial facts, theories, and issues. More of what currently goes on backstage in the scientific community has to become more visible if people are going to get a clearer idea of the potential and limitations of the new wonders science is proclaiming.[28] Bodmer, in 1985, legitimized science communication and mobilized the scientific community to carry it out. The House of Lords report, in the year 2000, must be seen as clearing the way for full, frank, and publicly inclusive dialogue, discussion, and debate about science and its implications for individuasls and society.

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Author

Steve Miller is Reader in Planetary Science and Science Communication at University College London, Gower Street, London WC1E 6BT, United Kingdom. With Jane Gregory, he is the author of *Science in Public: Communication, Culture, and Credibility* (London: Plenum, 1998).